On-Street Bicycle Facility Design Approach

The following guidelines are a supplement to the MUTCD Part 9: Traffic Control for Bicycle Facilities and the AASHTO *Guide for the Development of Bicycle Facilities.* They are not design standards, and should not be used as such. Application of guidance provided in this document requires the use of professional engineering judgment when installing bicycle lanes, shared lane markings and other bicycle facilities.

Bicycle Lanes

The minimum width for a bicycle lane between a parking lane and a travel lane is 5 feet. The inside bicycle lane line (parking lane line) will be located 7 to 8 feet from the face of the curb or roadway edge. Generally, a narrower parking lane is desirable to encourage motorists to keep the vehicle as close to the edge of the roadway as possible to maximize the available travel lane width, which will improve the bicyclist's level of comfort on the roadway.

The minimum width of a bicycle lane next to a curb (no parking) is 5 feet from the face of curb, but the bike lane must also be at least 3 feet from the joint between the gutter pan and the road pavement (4 feet preferred). In general, bicycle lanes should be no wider than 6 feet to discourage motor vehicles from using them as a travel lane. Bicycle lane lines should not be extended through a marked crosswalk.

Bicycle lanes should be one-way facilities and carry bicycle traffic in the same direction as adjacent motor vehicle traffic. Two-way bicycle lanes on one side of the roadway are not recommended when they result in bicycles riding against the flow of motor vehicle traffic.

Considerations for Use of Dotted versus Solid Bicycle Lane Lines

Solid lines should be used at all locations where through moving motorists are to be discouraged from entering the bicycle lane. Parking motorists may cross the solid line as necessary to park their vehicle.

Dotted lines (2-foot lines with 4-foot gaps) should be used to demarcate areas where motorists are likely or are to be encouraged to merge into or across the bicycle lane for turning movements. Dotted lines should be used 50-200 feet in advance of intersections where motorists are permitted to turn right. Green bike lanes (not in AASHTO), when used, are often placed within the dotted merge area. Where there is a parking restriction in advanceof an intersection, including bus stops, the dotted line should be continued through the parking restriction. The dotted line should generally discontinue at the crosswalk or back edge of the perpendicular street sidewalk if a crosswalk is not present on the near side of an intersection. On the far side, the dotted line should become a solid line at the back edge of the sidewalk or the tangent point of the curb radius (whichever is larger). A dotted line through an intersection may be desirable to provide additional guidance through intersections where bicyclists must cross more than 4 lanes of traffic or cross uncontrolled intersections of any width. Finally, dotted lines may be used through minor intersections where the side streets are stop controlled.

Considerations for Bicycle Lane Symbol Placement

The bicycle lane bicycle with rider symbol with an arrow should be used to identify bicycle lanes. Typically, the bike lane arrow and rider symbol should be located within the center of the bike lane. To

reduce wearing, bicycle lane symbols are typically not located within dotted bike lanes; however, it may be desirable to place bicycle lane symbols within dotted lines at locations of frequent conflicts between merging motorists and through-moving bicyclists.

Considerations for Bicycle Lane Symbol Placement Frequency

Bicycle lane symbols should be placed at the far side of an uncontrolled intersection, at both sides of an arterial intersection with traffic control, and at mid-block locations where block faces are more than 250 feet. Where there are marked crosswalks, the tip of the bicycle lane symbol should be placed 25 feet beyond the far side of the marked crosswalk. The frequency of placement of a bicycle lane symbol will depend on a number of factors, including the following:

- Visibility to motorists and bicyclists (markings should be placed to take into account changes in topography or not be blocked by overhanging vegetation or signs when looked at from a distance).
- Generally, the markings should be located in accordance with the proposed guidelines (far side of intersections; then mid-block if block faces are more than 250 feet long).
- Generally the markings should not be located adjacent to each other when located mid-block. It is recommended that they be separated by a minimum of 20 feet.
- Markings may be adjusted from the above dimensions to stay out of the wheel track of turning vehicles to lengthen lifespan.

Bicycle Lanes and Right Turn Lanes

The following figures illustrate several scenarios in which bicycle lanes are integrated into a roadway with dedicated right turn lanes. It is recommended that the transition for tapering centerlines and travel lanes (moving the lines gradually to the right or the left) to create space for bicycle lanes follow standard MUTCD and AASHTO practices.

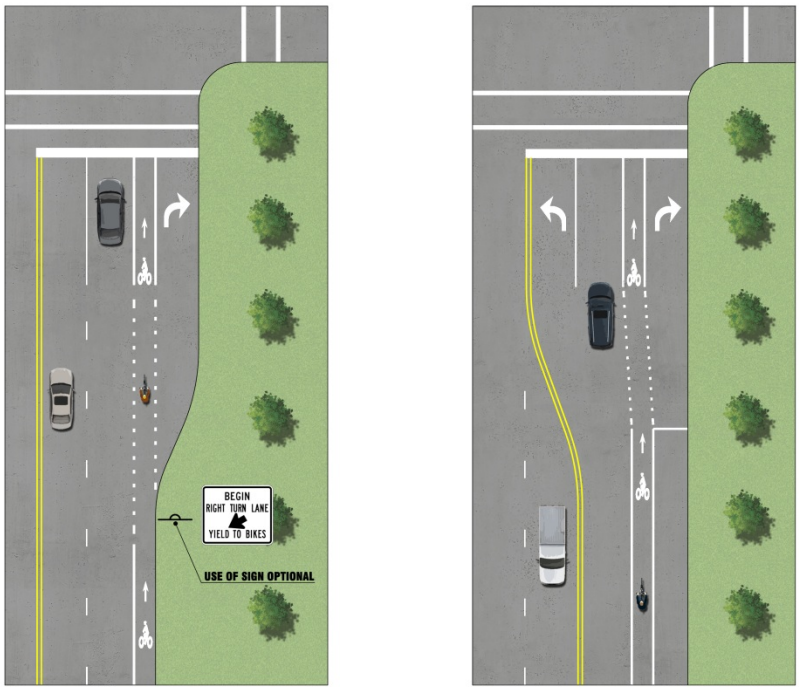


Figure: Examples of bike lanes approaching right-turn only lane (with and without parking)

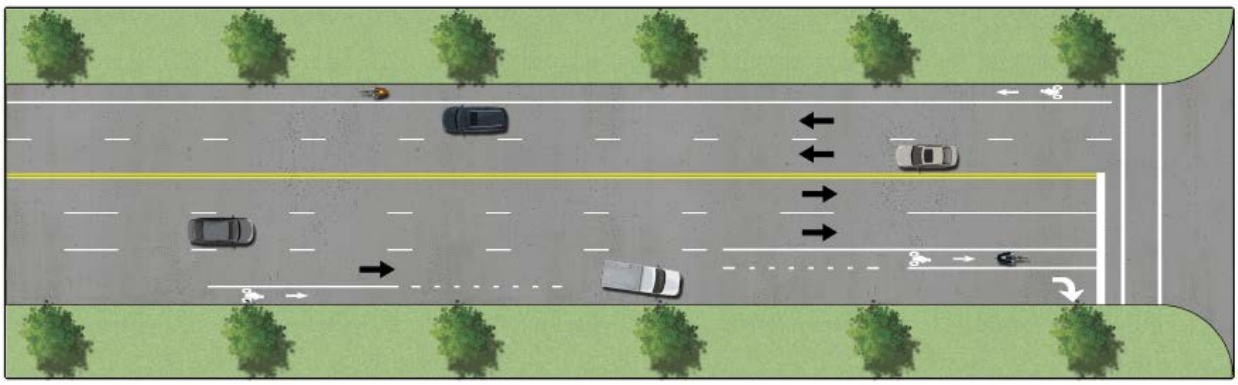
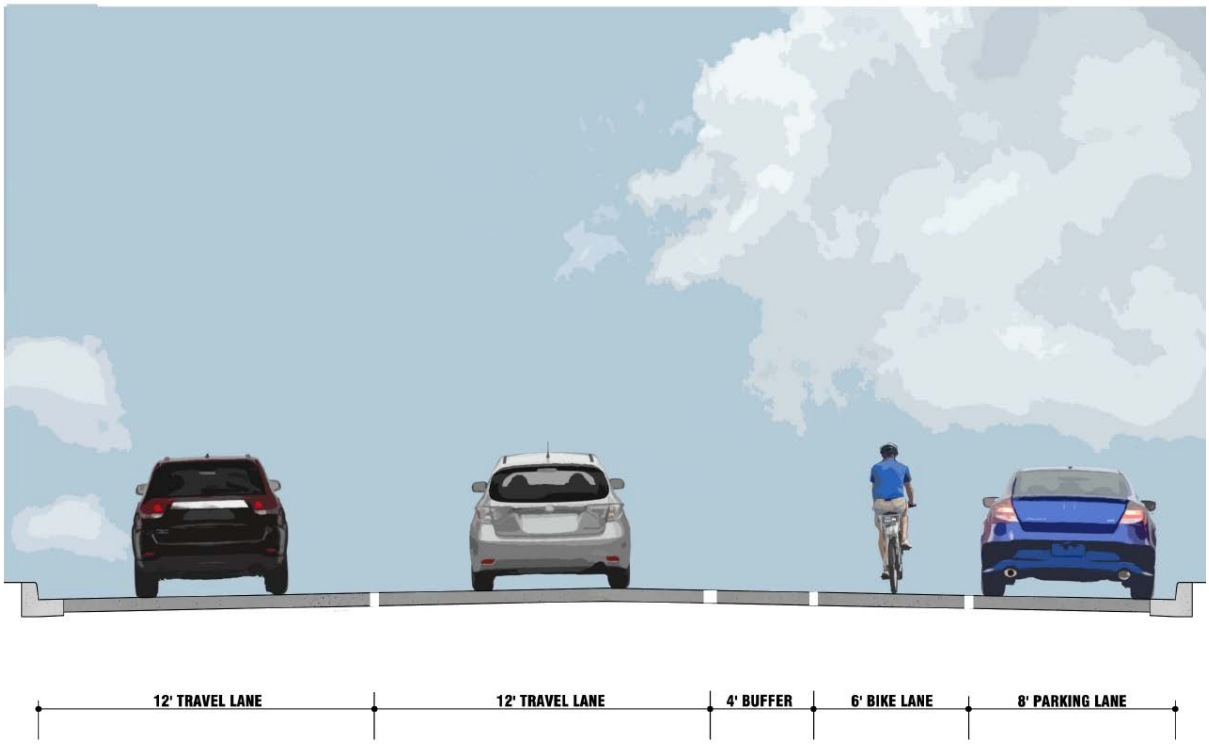


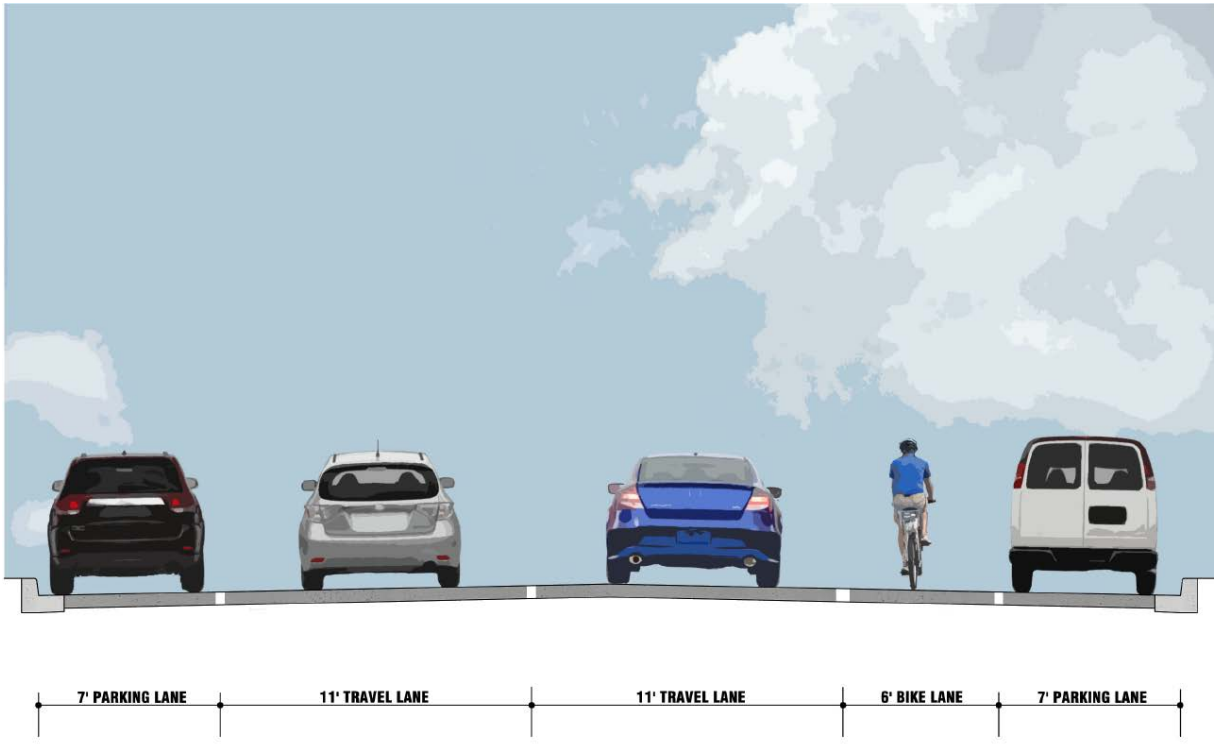
Figure: Example of Bike lane with through lane transitioning to the right-turn only lane

Bicycle Lanes on One-Way Streets

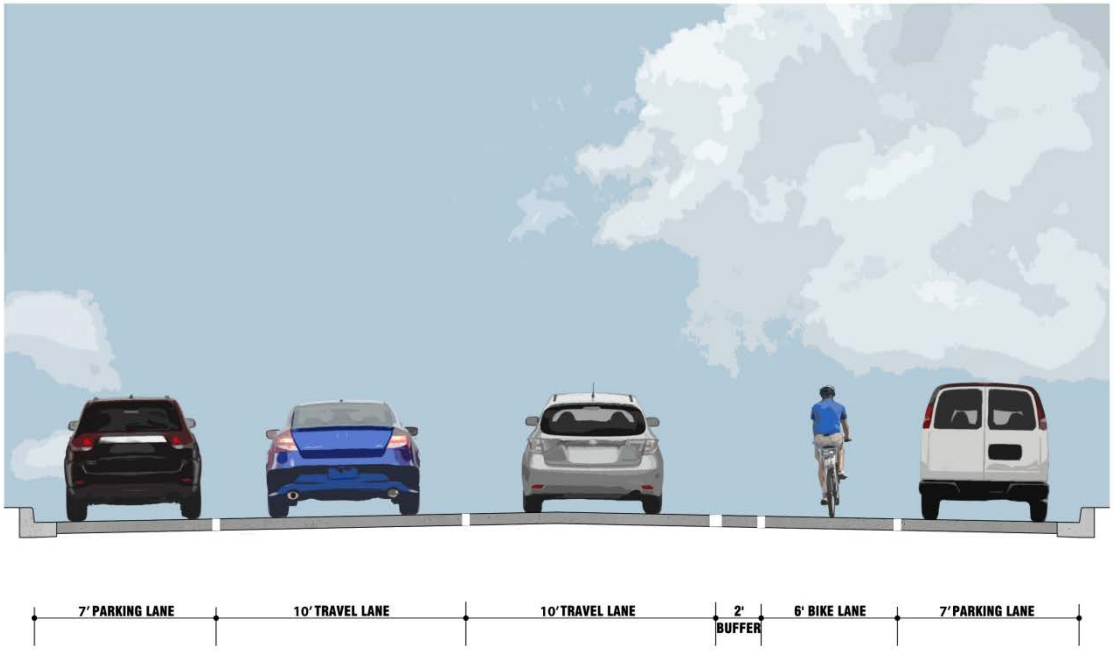
On one-way streets, bicycle lanes generally should be placed on the right side of the street. Bicycle lanes on the left side are unfamiliar and unexpected for most motorists. This should only be considered when a bicycle lane will substantially decrease the number of conflicts, there are a significant number of left-turning bicyclists or the right lane is unavailable because of a special purpose lane, such as a transit lane. The following figures illustrate several different options to integrating bicycle lanes on one-way roadways in Wichita.



Option 1: Two general purpose lanes, one parking lane and buffered bike lane



Option 2: Two general purpose lanes, two parking lanes and bike lane



Option 4: Two general purpose lanes, two parking lanes and buffered bike lanes

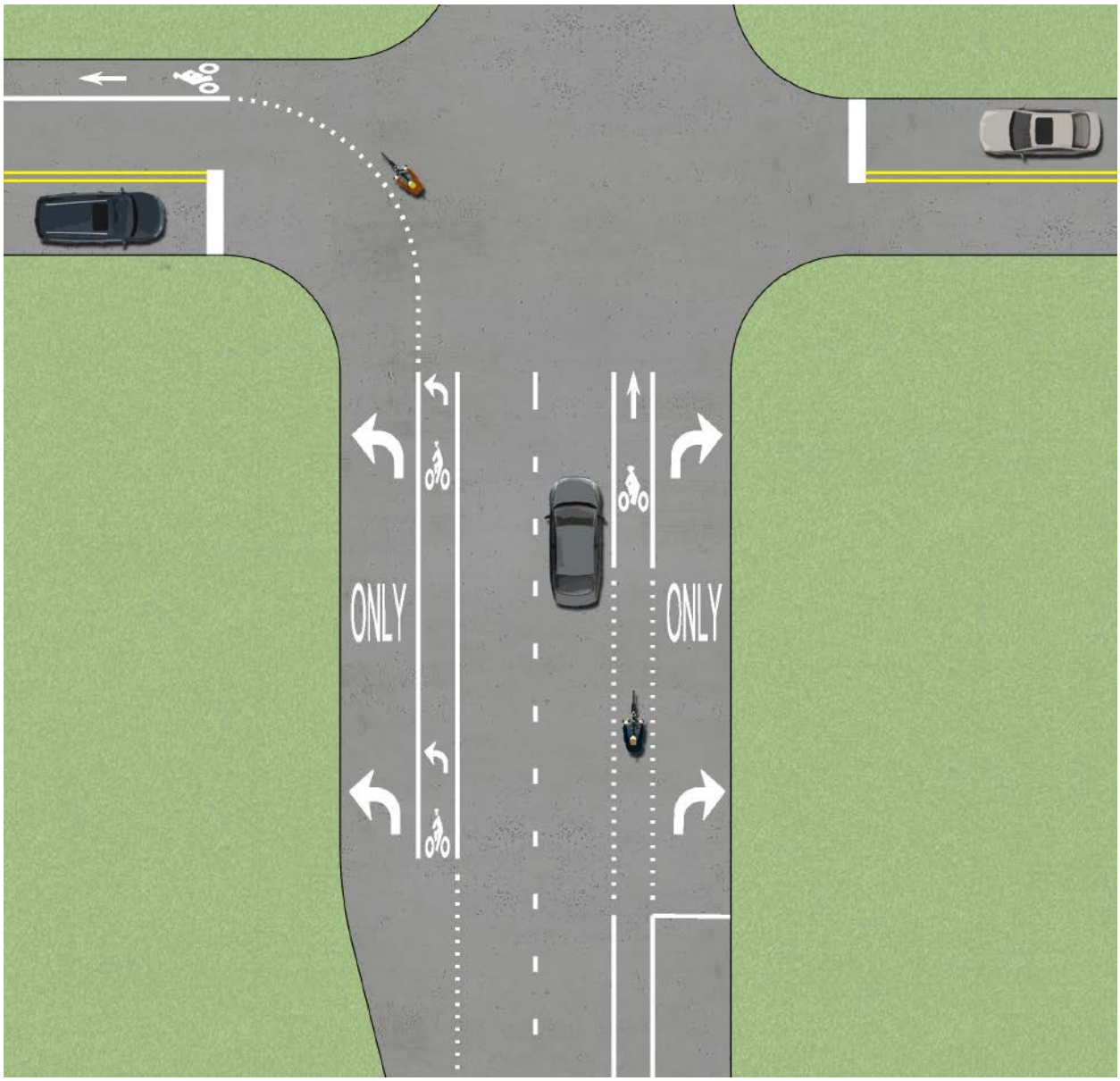


Figure X: Bike left-turn only lanes can be used on one-way streets to provide a dedicated space for left-turning bicyclists and to help direct them through the intersection to a receiving bicycle facility. Bicyclists are expected to transition from the bicycle lane on right side of street to the left-turn bicycle lane several hundred feet before the intersection.

Buffered Bicycle Lanes

A buffered bike lane is a bike lane that is separated from a travel lane or parking lane by a space of 3 to 6 feet. The lane is always one-way and is buffered by cross-hatched pavement marking, and if used, a sign for the exclusive use of bicyclists. The space between cross-hatching is flexible, but typically varies between 5 and 25 feet. Consider discontinuing cross-hatching through areas where motor vehicles may cross such as at driveway entrances and bus stops. All other guidelines and considerations that apply to bike lanes described above, also apply to buffered bike lanes. The MUTCD guidelines allow buffered bike lanes per the buffered preferential lanes found in section 3D-01.

Shared Lane Markings

A Shared Lane Marking is a pavement symbol consisting of a bicycle with two chevron markings above it that is placed in the roadway lane indicating that motorists should expect to see and share the lane with bicycles, and indicating the legal and appropriate line of travel for a bicyclist. Unlike bicycle lanes, they do not designate a particular part of the roadway for the exclusive use of bicyclists.

The following guidelines supplement the 2009 MUTCD and the forthcoming revised *AASHTO Guide for the Development of Bicycle Facilities*. They are not design standards, and should not be used as such. Application of guidance provided in this document requires the use of engineering judgment when installing shared lane markings.

The revised 2009 Edition of the MUTCD includes new provisions for installing Shared Lane Markings. The following is taken directly from the 2009 Edition of the MUTCD.

The Shared Lane Marking shown in Figure 2 may be used to:

- Assist bicyclists with lateral positioning in a shared lane with on-street parallel parking in order to reduce the chance of a bicyclist's impacting the open door of a parked vehicle,
- Assist bicyclists with lateral positioning in lanes that are too narrow for a motor vehicle and a bicycle to travel side by side within the same traffic lane,
- Alert road users of the lateral location bicyclists are likely to occupy within the traveled way,
- Encourage safe passing of bicyclists by motorists, and
- Reduce the incidence of wrong-way bicycling

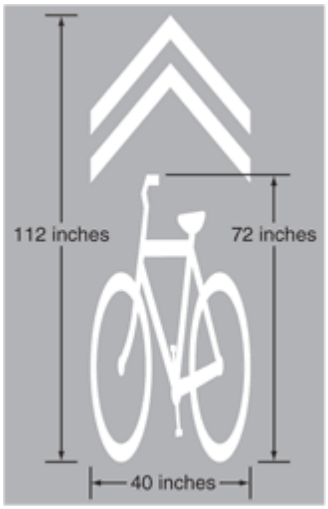


*Figure 2: Shared Lane Marking*Source: MUTCD, 2009 edition.

Shared Lane Marking Placement

In general, Shared Lane Markings are installed on streets where there is not enough space for bicycle lanes, or there is no desire for a bicycle lane. When bike lanes are desired but space limitations exist, a bike lane can be installed on one side of the street (the up-hill side of the street to provided dedicated space for slower, hill climbing bicyclists) and Shared Lane Markings on the downhill side. Flat streets should either have Shared Lane Markings installed on both sides (no bicycle lane) or have the bicycle lane installed on the side with the highest anticipated bicycle use (engineering judgment required). Shared Lane Markings may be the first choice (even if there is room for a bicycle lane) on some downhill sections.

Consideration for Shared Lane Marking Placement within a Travel Lane

The placement of shared lane markings will require engineering judgment as lane widths, quantity of lanes, operating speeds, and presence of parking will vary from street to street. In particular, the width of the shared travel lane and the number of available travel lanes impact typical operating behavior of motorists and bicyclists. Travel lanes with widths less than 13 feet will require motorists to partially or

fully change lanes to pass bicyclists. Travel lanes of 13 feet or greater generally allow motorists to pass bicyclists with minimal or no encroachment into adjacent travel lanes (allowing 3 feet of horizontal separation between the motorist and bicyclist).

Generally, the center of shared lane markings should be located a minimum of 11 feet from the curb or edge of roadway at locations where parking is permitted adjacent to the travel lane. Generally, the center of shared lane markings should be located a minimum of 4 feet from the curb or edge of roadway at locations where parking is prohibited.

It may be appropriate to move the shared lane marking towards the center of the travel lane (exceeding the MUTCD minimums) if engineering judgment determines that this placement will enhance the safety of the bicyclist operating within the travel lane. The shared lane marking may be moved towards the center of the lane regardless of whether it is adjacent to parking or not. In most cases, it will be a combination of two or more of the following factors which will indicate that consideration should be given to moving the Shared Lane Marking towards the center of the travel lane:

- Travel lane is less than 12 feet in width
- Speed of traffic
- Number of travel lanes (it may be desirable to place the shared lane marking towards the center of a narrower outside travel lane when a center turn lane is present or when there are multiple travel lanes in the same direction)
- Grade of roadway and expected bicyclist speed (center lane placement often works well when going downhill on streets with grade and higher bicycle speeds)
- Volume of traffic (may or may not be an issue – speed, grade, and number of lanes are more important)

Situations Where Travel Lanes Are Less than or Equal to 12 Feet in Width

Shared lane markings should be placed in the center of the travel lane where travel lanes are less than 12 feet to encourage bicyclists to occupy the full lane and not ride too close to parked vehicles or the edge of the roadway. A BIKES MAY USE FULL LANE (R4-11) sign may be used to supplement the marking. Travel lanes of this dimension are too narrow for sharing side by side with vehicles.

Situations Where Travel Lanes Are Between 12 Feet and 13 Feet in Width

Where travel lanes are 12-13 feet in width, the travel lane can appear shareable to roadway users if bicyclists operate on the right side of the lane resulting in unsafe passing maneuvers. It may be desirable to place the marking in the center, or close to the center of the lane to discourage these behaviors. A BIKES MAY USE FULL LANE (R4-11) sign may be used to supplement the marking.

Situations Where Travel Lanes Are Greater than or Equal to 13 Feet in Width

Where travel lanes are 13 feet or wider, motorists will generally be able to pass bicyclists within the same lane or will only need to slightly encroach on adjacent lanes to pass bicyclists. The Shared Lane Marking should generally be located in the right portion of the lane (per the MUTCD minimum requirements) with exceptions for locations adjacent to parking where it is desirable to encourage riding

further from parked vehicles. A Share the Road sign (W11-1 AND W16-1P) may be used to supplement the marking.

Shared lane markings should generally be used on arterial and non-arterial roadways with motor vehicle speeds 35 mph or less. Research has shown placing the marking in the center of travel lanes wider than 13 feet will likely result in poor compliance by bicyclists who will travel in the right portion of the lane which may undermine the effectiveness of shared lane markings in narrower lanes.

Considerations for Parking Lane Line Placement

Where there are no parking restrictions, the Shared Lane Marking should be placed in conjunction with a 4 inch solid or dotted white parking lane stripe (2 foot line with 4 foot gaps). The dotted line should be used through uncontrolled intersections where there is no arterial traffic control and where there are parking restrictions, including bus stops. The intent is to reinforce parking restrictions and to provide a continuous visual cue for the bicyclist to track along. The parking lane line will be located 7 to 8 feet from the face of the curb or roadway edge. Generally, a narrower parking lane is desirable to encourage motorists to keep the vehicle as close to the edge of the roadway as possible to maximize the available travel lane width, which will improve the bicyclist's level of comfort on the roadway.

Considerations for Symbol Placement Frequency

Shared Lane Markings should be placed at the far side of an uncontrolled intersection, at both sides of an arterial intersection with traffic control, and at mid-block locations where block faces are more than 250 feet long.

When placing mid-block Shared Lane markings, they should be placed in such a manner that the first Shared Lane marking a bicyclist or motorist would come upon would be the Shared Lane marking in their direction of travel. The Shared Lane markings should be offset from each other 20 feet from the tip of the leading (top) chevron to tip of leading (top) chevron.

Where there are mid-block marked crosswalks, the tip of the chevron should be placed 25 feet beyond the far side of the marked crosswalk.

Considerations for Shared Lane Marking Placement –Streets without Centerline

Shared Lane Marking installation on local streets or streets without a centerline should generally follow the guidelines mentioned above. However, no parking lane stripes should be installed. Utilizing the marking on non-arterial streets may require that the Shared Lane Markings be offset at intersections to prevent the symbols from overlapping. The tips of the leading (top) chevrons should be separated by at least 10 feet.

Transitions Between Different Bicycle Facility Types

It is often necessary to use different bicycle facilities to provide bicycle access within the same roadway corridor due to existing roadway conditions, surrounding land uses, available right-of-way, and other characteristics. Where this condition occurs, it is important to provide transitions between different facilities. These transitions can be made safer and more understandable for bicyclists and motorists with appropriate and consistent treatments such as spot directional signs, warning signs, pavement markings, curb cuts, etc. Transitions should be provided as a part of the bicycle facility design process.

Bike Lanes to Shared Lanes

At locations where bike lanes terminate to become shared lanes it may be desirable to provide a transition to a marked shared lane for a brief distance, even if it is not desirable to mark a continuous shared lane for the remainder of the roadway. The placement of the shared lane marking should conform to guidance provided above. It is recommended that a SHARE THE ROAD sign (W11-1 and W16-1P) be used for shared lane situations where the lane is wider than 13 feet and BIKES MAY USE FULL LANE (R4-11) signs be used for narrower lane widths. The taper terminating the bike lane should also conform to the MUTCD (Figure 3B-14, 2009 MUTCD) shown here in Figure x.

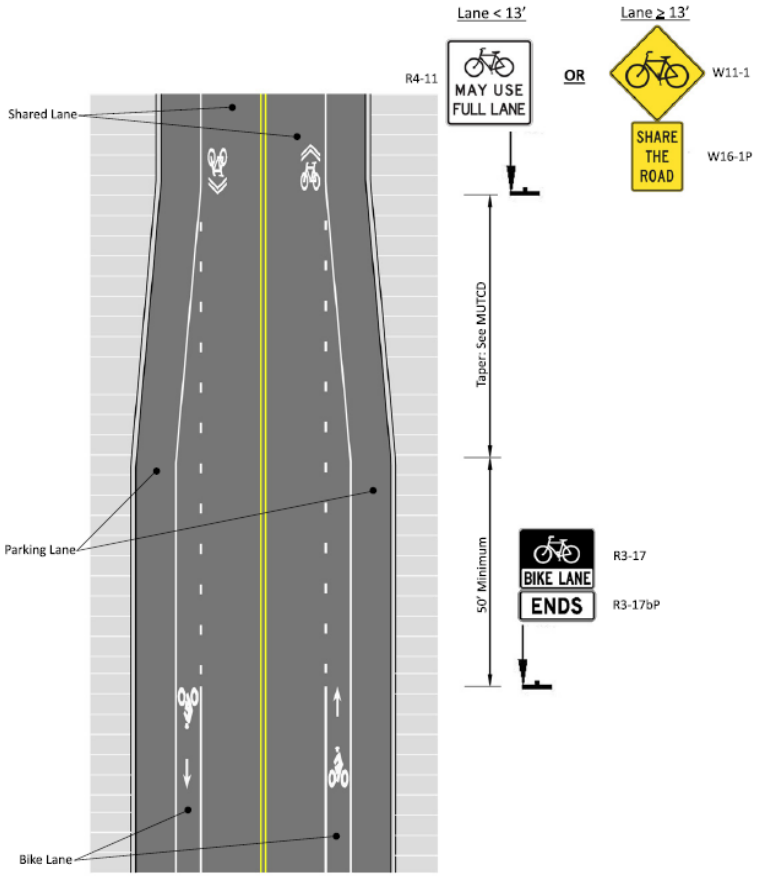


Figure X: Transition from bike lane to shared lane marking

Path System and the On-Street Bicycle Network Transition

Where a shared use path crosses or terminates at an existing road, it is important to transition the path into the system of on-street bicycle facilities and sidewalks. Care should be taken to properly design the terminus to transition the bicycle traffic into a safe merging of intersecting facilities.For example, a path that transitions to an on-street facility should transition a bicyclist to the correct side of the street thereby reducing the possibility of wrong-way riding. Where possible, provide additional space where paths intersect roadways, particularly at signalized locations where multiple path users are likely to be waiting to cross the street. Curb ramps at path crossings and other on-street access points should be assessed and widened where they are narrower than the path width and/or where the volume of path users is high.

Appropriate signing is necessary to warn and direct both bicyclists and motorists regarding these transition areas. Each roadway crossing is also an access point, and should, therefore be designed to facilitate movements of path users who either enter the path from the road, or plan to exit the path and use the roadway.

Bicycle Boulevards (see Appendices __)